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On November 9, 5ʰ 15ᵐ P. M., a splendid fireball was seen here and from several other places in Denmark, but the cloudy weather made any exact observations impossible.

A NEW REPETITION OF FOUCAULT'S PENDULUM EXPERIMENT.

On the 20th, 21st, 22d and 23d of July, 1892, I made a public trial of FOUCAULT'S Pendulum Experiment in the King's Chapel of Christiansburg, at Copenhagen. The pendulum had a length of 30 metres and weighed 35 kilogrammes, the cylinder being of lead. The whole arrangement was the same as that mentioned in the *Publications of the Astronomical Society of the Pacific*, No. 24, pp. 133, 134, with the difference that a long table was placed below the pendulum in order to show the turning of the ground in a more convenient manner. The whole series of experiments was witnessed by about 1000 spectators.

ODDER, DENMARK, January 7, 1893.

AN EASY METHOD OF ADJUSTING AN EQUATORIAL TELESCOPE.

BY ROGER SPRAGUE.

It will be well to say in advance that this paper is only intended for the amateur astronomer. The method of adjusting an equatorial here discussed is one which could be very easily thought out in a few minutes by the experienced practical astronomer or mathematician who might chance to be placed in circumstances which would render such a method advisable or necessary. The only reasons for presenting it at all are that it is described in no standard work easily accessible to the amateur astronomer (indeed, I have never seen it in print anywhere), and it is certainly the easiest and simplest method possible, being quite accurate enough for all ordinary purposes, provided the instrument be well made.

The first thing to do in adjusting an equatorial is to adjust the finder. This is done by turning the telescope on some bright star, or distant object, and bringing said object into the center of the telescopic field. The finder is then adjusted by means of the screws provided for the purpose until the intersection of the cross-wires is exactly upon the object at the same time that it is in the middle of the field of the telescope.

The second thing to do is to find the index-error or meridian reading of the hour circle. This is best done by SCHAEBERLE'S method, which may be found in full on page 136 of Prof. CAMPBELL'S *Practical Astronomy*, two copies of which are in the library of the A. S. P., or in *Astronomische Nachrichten*, No. 2374. But as it may not be convenient for every one to refer to those publications, I shall briefly recapitulate the method here. A stick is first fastened across the middle of the object end of the telescope (or of the finder if extreme accuracy is not desired, but rather a gain of convenience). This stick must be roughly parallel to the declination axis, and to the end opposite to the declination axis a string must be fastened, which must be led down through that one of the capstan-headed screws used to adjust the finder, which is opposite to the declination axis. This screw must, of course, be turned until the hole through it is parallel to the optical axis of the telescope. To the lower end of the string is attached a plumb-bob, which is finally allowed to swing in a vessel of water. The telescope is then brought into such a position (nearly vertical) that the string will swing free of the sides of the hole. The instrument is then clamped so that the string is as near as may be in the exact center of the hole, and the verniers of the hour circle read. The telescope is then reversed to the opposite side of the pier, being very careful not to disturb in any way the attachment of the string to the object end of the telescope, and the hour circle again read. The mean of the readings of the hour circle in the two positions gives the reading of the circle when the instrument is in the meridian. The meridian reading of each vernier should be determined separately to avoid confusion.

To adjust the instrument in azimuth, the hour circle is set at its meridian reading and the instrument clamped in right ascension a little before *Polaris* passes upper or lower culmination. The telescope is left unclamped in declination, and by swinging the tube in declination it is brought to point as nearly as possible on *Polaris*. It can then be easily seen by glancing along the tube whether the telescope is pointing too far to the east or west, and it is possible to move it in azimuth by means of the adjusting screws until *Polaris* is brought into the field of the finder and then into the field of a high power eye-piece (the higher the power the better) on the equatorial itself. At the time, as near as may be, when *Polaris* crosses the meridian the star is brought into the center of the field, and the adjustment in azimuth is complete.

To adjust the instrument in altitude, it is clamped in right ascension six hours off of the meridian, and when *Polaris* approaches eastern or western elongation the instrument is again swung in declination until it is pointing as nearly as possible to the star. It is then possible, by glancing along the tube, to see whether it is pointing too high or too low, and to correct this error by changing the inclination of the polar axis until the star is brought into the center of the field of view at the minute when the star is six hours off the meridian. The adjustment of the instrument is then complete.

The sidereal time for the upper culmination of *Polaris* is given for every day in the year in the *American Ephemeris*, pages 302–313. Those who do not possess a sidereal chronometer will need to know how to change this sidereal time into mean time. The process can be best illustrated by an example. Suppose we wish to find the mean time when *Polaris* shall cross the meridian of San Francisco on the night of April 15, 1893. Turning to page 57 of the *Ephemeris*, we find that the sidereal time of mean noon at Greenwich on April 15 is $1^{h}\ 35^{m}\ 28^{s}$. To find the sidereal time of mean noon at San Francisco on that date we take the longitude of San Francisco in time ($8^{h}\ 9^{m}$) and go with it to Table III, page 526. Placed opposite to $8^{h}\ 9^{m}$ we find $1^{m}\ 20^{s}$. This added to the $1^{h}\ 35^{m}\ 28^{s}$ gives us the time we want, or $1^{h}\ 36^{m}\ 48^{s}$. Next, turning to page 305 of the *Ephemeris* we find that *Polaris* crosses the meridian at $1^{h}\ 18^{m}\ 24^{s}$, sidereal time. From this time (plus 12^{h} for lower culmination) we subtract the $1^{h}\ 36^{m}\ 48^{s}$ and get $11^{h}\ 41^{m}\ 36^{s}$. Taking this time to Table II, page 523, we find placed opposite it $1^{m}\ 55^{s}$. Subtracting this from $11^{h}\ 41^{m}\ 36^{s}$ gives $11^{h}\ 39^{m}\ 41^{s}$. This is the mean time for the lower culmination of *Polaris* at San Francisco on the night of April 15. To change this to Pacific standard time we must add 9^{m}. The whole example may be stated as follows:

	h.	*m.*	*s.*
April 15, sidereal time (at Greenwich mean noon) .	1	35	28
Reduction for $8^{h}\ 9^{m}$ in Table III		+ 1	20
Sidereal time of local mean noon	1	36	48
Given sidereal time (+ 12^{h} if necessary)	13	18	24
	11	41	36
Reduction for $11^{h}\ 41^{m}\ 36^{s}$ in Table II		− 1	55
Required mean time	11	39	41
Reduction to standard time		+ 9	
Required standard time	11	48	41

In this example the time has in no case been taken closer than seconds, as this is more than sufficiently accurate for the purpose. Practically a watch error of ± 2^m would be perfectly allowable, as it would not vitiate the adjustment by as much as a minute of arc, an insignificant amount.

The principal advantage of this method of adjustment is that it does away altogether with the use of the finely divided declination circle. As the reading of this circle is always the most laborious and lengthy part of any ordinary method of adjustment, and is the especial dread of amateur astronomers, the importance of this point need not be dwelt on.

NAPA COLLEGE, NAPA, CAL.,
March 21, 1893.

MISCELLANEOUS OBSERVATIONS OF *NOVA AURIGÆ.*

By W. W. CAMPBELL.

(*a*). In the *Monthly Notices of the Royal Astronomical Society* for January Dr. ISAAC ROBERTS gives the following account of his attempts to photograph any nebulosity that may be connected with *Nova Aurigæ:*

"A photograph of the region of *Nova Aurigæ* was taken on October 3, 1892, with the 20-inch reflector, and exposure of 110 minutes, upon which the *Nova* appears as a star, as well defined as any of the other stars, which are very numerous, on the plate. There is no trace of nebulosity surrounding the *Nova*, or in its vicinity, and there is no feature about it suggestive that it is different from other stars. The diameter of its photo-image measures 21 seconds of arc, and about 85 seconds distant from it, on the north-following side, is a star, the photo-image of which measures 23 seconds of arc; the *Nova* is therefore 2 seconds in diameter less than the star.

"On December 25, 1892, another photograph was taken of the same region, with an exposure of 20 minutes, upon which the *Nova* has a photo-image of 13 seconds of arc, and the star referred to has a diameter of 16 seconds.

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